NWFSC Assessment-Related Research

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NOAA FISHERIES

NW Fisheries
Science Center

Question

Is the Center conducting the research necessary to improve stock assessments and produce timely and assessment-relevant scientific research products?

Outline

- Data-rich methods
- Data-limited methods
- Biological processes
- Biological reference points
- Survey analysis and interpretation
- Management strategy evaluation
- Bayesian priors
- Ageing error methods
- Compositional reweighting
- Compositional expansion
- Mixed-effects methods
- Regional status

Data-rich methods (1/2)

- **Stock Synthesis**
  - Recruitment bias-correction (Methot and Taylor 2011 CJFAS)
  - Documentation (Methot and Wetzel 2014 Fish Res)
- **R4SS**
  - Tool used internationally for using SS3 (CSIRO, S. America, Seychelles)
- **Designating stock boundaries**
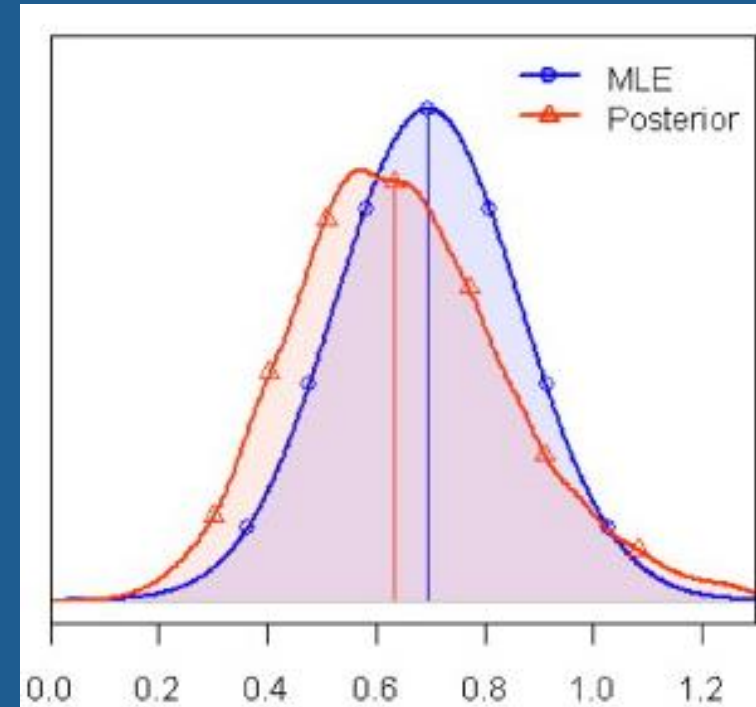 - Using survey data (Cope and Punt 2009 CJFAS)

Data-rich methods (2/2)

- **Uncertainty**

    - Bayesian vs. MLE (Stewart et al. 2013 Fish Res.)

    - Projections (Ralston et al. 2011 Fish. Bull.)

- **Selectivity**

    - Growth or domes? -- Taylor and Methot (2013) Fish Res

    - Semiparametric forms -- Thorson and Taylor (2014) Fish Res

Estimate of 2010 SPR for Pacific hake (Stewart et al. 2013)

Data-limited methods (1/2)

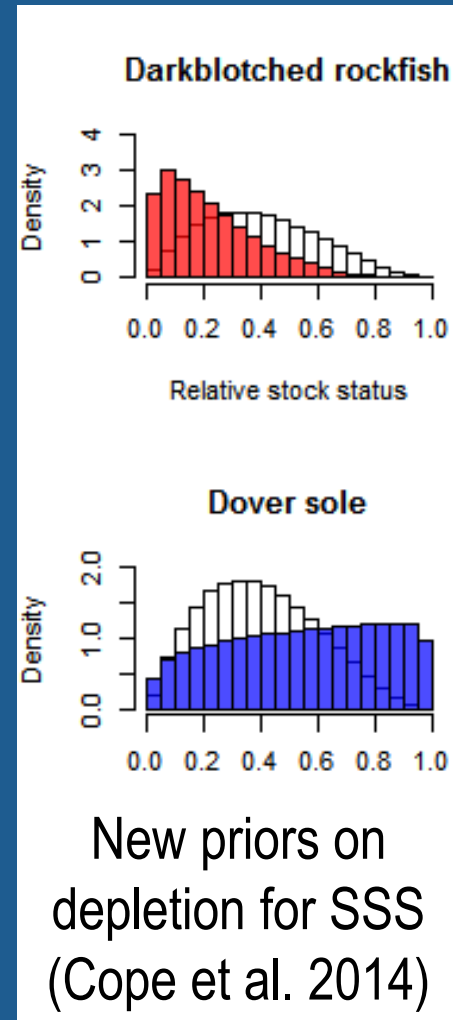**Necessary for increasing through-put of assessments**

- Alternative models

  - SSS and XSSS – Using Stock Synthesis for age-structured data-poor and data-moderate assessments (Cope 2013)

  - DB-SRA and DCAC – biomass dynamics models for data-poor assessments (MacCall 2009, Dick and MacCall 2011)

- Evaluating methods

  - Wetzel and Punt (2011a) Mar. Fresh. Res.

  - Wetzel and Punt (2011b) Fish Res

  - Wetzel and Punt (In review)

Data-limited methods (2/2)

Necessary for increasing through-put of assessments

- Develop methods for new data streams to include
  - Thorson and Cope (2014) Fish. Res. – Catch-curve stock reduction analysis
  - Cope Thorson Wetzel DeVore (In review) Fish. Res. – PSA for priors on depletion
- Productivity-Susceptibility Analysis
  - Cope et al. (2011)
- Others
  - Effort dynamics (Thorson et al. 2013 CJFAS)
  - Catch and status (Thorson Branch Jensen 2012 CJFAS)
  - Current methods (Berkson and Thorson Press ICESJMS)

New priors on depletion for SSS (Cope et al. 2014)

Biological processes

- **Need to input maturity schedule**
  - Developed protocol for double-reading of maturity data (Stokes, Head, Thorson in prep.)
  - Synthesizing information on fecundity allometry (Dick dissertation)
- **Variation in growth**
  - Developed priors on growth variability (Thorson and Minte-Vera in review)
  - Splitnose investigations (Gertseva Cope and Matson 2010 MEPS)
  - Greenstriped rockfish (Keller et al. 2012 Fish Res)
- **Variation in recruitment**
  - Environmental drivers of recriutment (Stachura et al. 2014)

Biological reference points

- **BRPs given time-varying process**
    - Haltuch et al. (2008, 2009) Fish Res.
    - Haltuch and Punt (2011) CJFAS
- **BRPs for length-based data-poor approaches**
    - Cope and Punt (2009) CJFAS
- **BRPs given stochastic recruitment**
    - Thorson Jensen Hilborn (in review)

Survey analysis and interpretation (1/2)

- **Improved software for index estimation**
  - Decade of work (Helser, Wallace, and others!)
  - Vessel effects (Thorson and Ward 2014 Fish Res)
  - Strata-year effects (Thorson and Ward 2013 Fish Res)
- **Analyzing patterns**
  - Adverse weather (Stewart et al. 2010 Fish Res)
  - Extreme catches (Thorson Stewart Punt 2011 CJFAS)

Survey analysis and interpretation (2/2)

- **Next-generation tools**
  - Geostatistical index standardization (Shelton, Thorson, Ward, Feist In review)
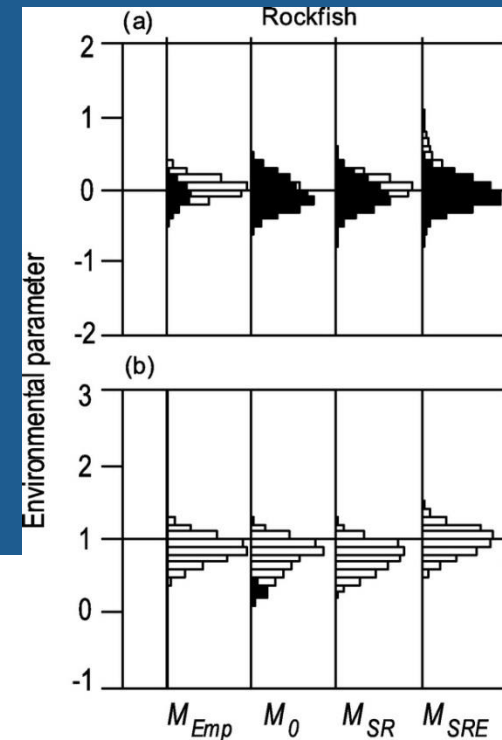 - Spatial delay-difference modelling (Thorson in prep)
- **New tools**
  - Hook-and-line (Harms et al. 2010 Fish Res)
  - Assemblage analysis (Cope and Haltuch 2012 MEPS)

Management Strategy Evaluation

- **Tools for data-moderate evaluation**
  - Wetzel in prep – exploring reduction analysis methods

- **Tools for data-rich evaluation**
  - Hicks, Grandon, Taylor, Taylor – software for MSE in Stock Synthesis

- **Given climate variation**
  - Haltuch and Punt 2011 CJFAS

Evaluating methods for estimating an environmental index of recruitment (Haltuch and Punt 2011 CJFAS)

Priors (1/2)

Still developing practices for estimating and incorporating prior information, including:

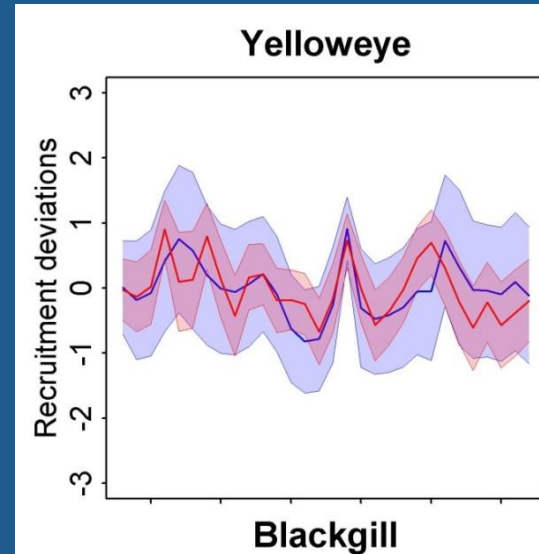- Best practices documented and published (Thorson Cope Kleisner Samhouri Shelton Ward Fish Fish 2014)

- Steepness (Ongoing updates…),

- Autocorrelation and variability in recruitment (Thorson Jensen Zipkin 2014 CJFAS)

- Variability in growth (Thorson and Minte-Vera in review)

Priors (2/2)

Still developing practices for estimating and incorporating prior information, including:

- Growth rates and natural mortality (Thorson Taylor Stewart Punt 2013)

- Growth rates and natural mortality (Thorson Taylor Stewart Punt 2013)

- Combining multiple natural mortality estimators (Hamel in prep)

- Correlations in recruitment (Thorson Stewart Taylor Punt 2013)

- Weight at age allometric (Froese Thorson and Reyes 2014)
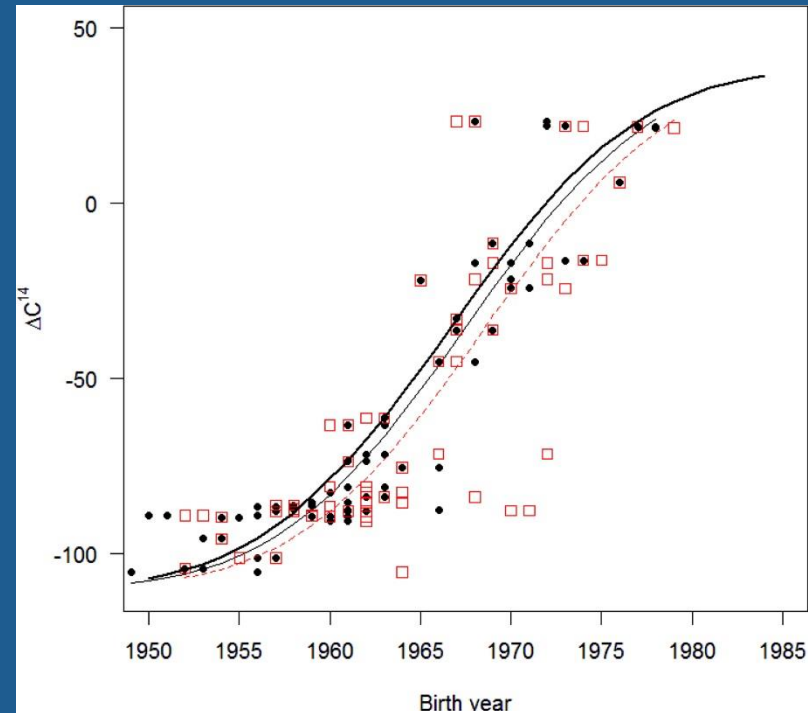
- Fecundity (Dick dissertation)

Estimating recruitment without (blue) and with (red) a shared index of recruitment strength (Thorson et al. 2013 MEPS)

Ageing error

Improvements in ageing error software to include:

- Ongoing improvements to R-package (nwfscAgeingError) on R-forge

- Cohort-specific errors, and

- Otolith weights, i.e. covariates for some data

- Petrale bomb-radiocarbon validation (Haltuch et al. 2012 CJFAS)

Comparison of bomb-radiocarbon (black line), surface reads (red squares) and break-and-burn reads (black circles) for petrale ageing, given birth year isotope readings (Haltuch et al. 2012 CJFAS)

Comp. Reweighting

Reweighting of compositional data within and/or externally to the model

- Francis (2014) method – implemented in R4SS

- Ianelli and McAllister method – implemented in in SS3 and R4SS

- Thorson (2014) ICESJMS – a model-based estimation approach for effective sample size

- Stewart and Hamel (2014) CJFAS – bootstrapping for estimating effective sample sizes

Expansion of compositional data

Developing generalized code

- Sharable in R using R-forge

  - Speeds up processing

  - Standardization will reduce possibility for errors!

- Stephens in prep

- Developing methods for estimating input sample sizes for subsequent down-weighting

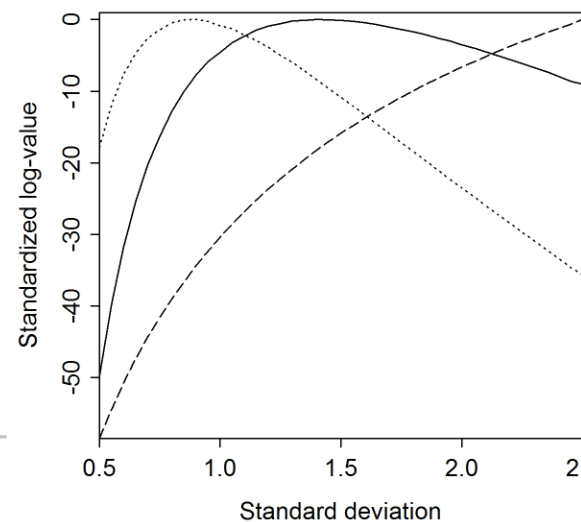 - Stewart and Hamel (2014) CJFAS
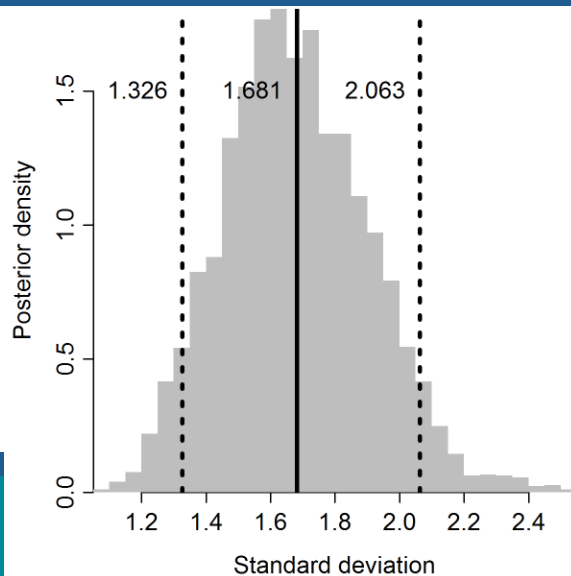
  - Thorson (2014) ICESJMS

Mixed-effect methods

Important to identify time-varying processes

- Reviewing mixed-effects tools
  - Thorson and Minto (in review)
- Laplace approximation for Stock Synthesis
  - Thorson Hicks Methot (2014) ICESJMS
- Spatial tools and productivity
  - Ono Shelton Thorson Ward Feist (in review)

Comparison of Laplace Approximation (right panel solid line) and Bayesian estimation (left panel) for recruitment variability in Pacific hake (Thorson et al. 2014 ICESJMS)

Regional status

- **Regional issues**
  - Bycatch
    - Moore et al. (2013) Environ. Cons.
    - Heery and Cope (2014) Fish. Bull.
  - Tradeoffs in harvest – Hilborn Stewart Branch Jensen (2012) Cons. Bio.
    - Habitat and spatial factor analysis – Thorson et al. (in prep)
- **Integrated ecosystem assessment**
  - Collaborating with CB division

NOAA FISHERIES

NWFSC Assessment Publications

- **Peer-reviewed**
  - 56 (2008-2014)
  - 36 first-authored by assessment team

- **In preparation**
  - 23 (2008-2014)
  - 15 first-authored